NETS 2026

Point Design for a Nuclear Electric Propulsion Mission to Uranus



Matthew Duchek

Aerospace Engineering Manager

Advanced Projects, AMA

ANS® American Nuclear Society

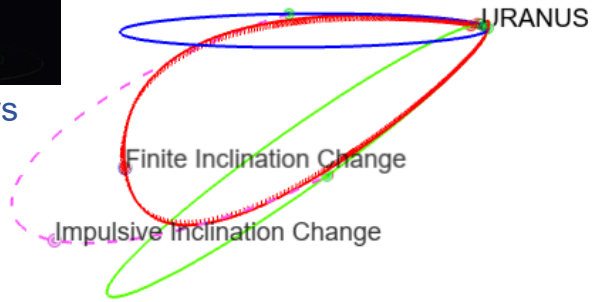
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Study Goal: Illustrate a NEP-enabled mission to engage scientists

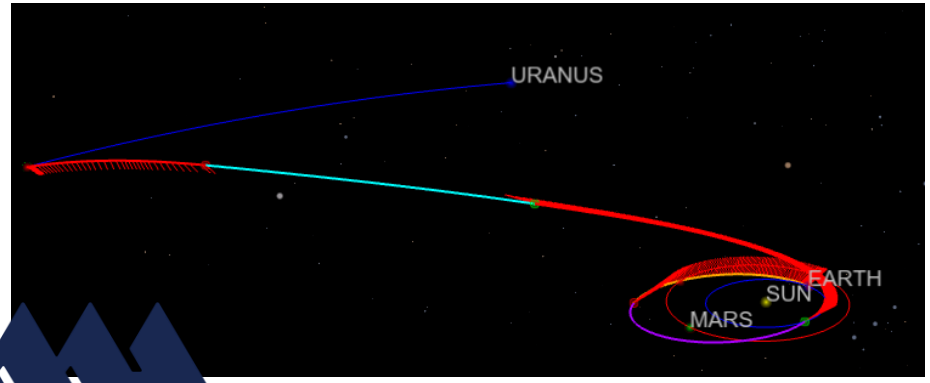
1. Illustrate the NEP system
2. Illustrate interplanetary transit with shortened trip time
3. Illustrate NEP-enabled propulsion at destination

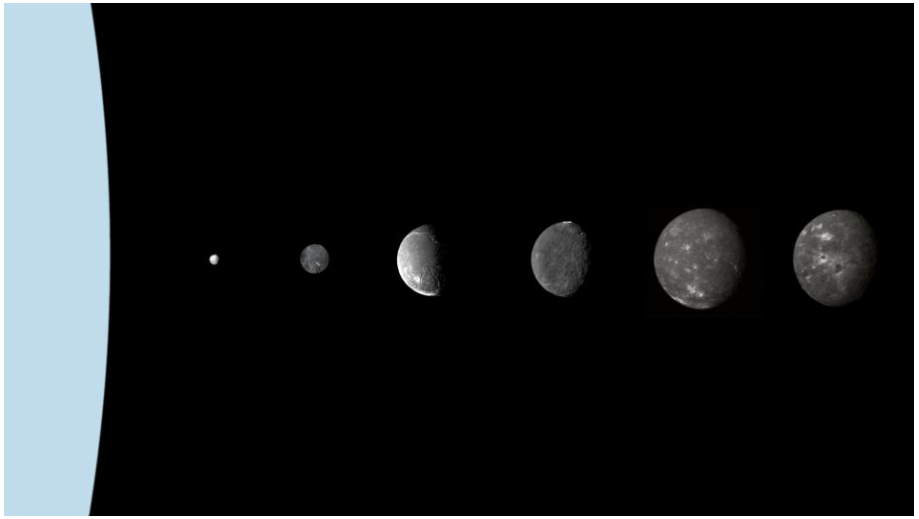


Uranus Orbiter & Probe Titania Flybys
Major Moons



NEP-Enabled inclination change in much less time



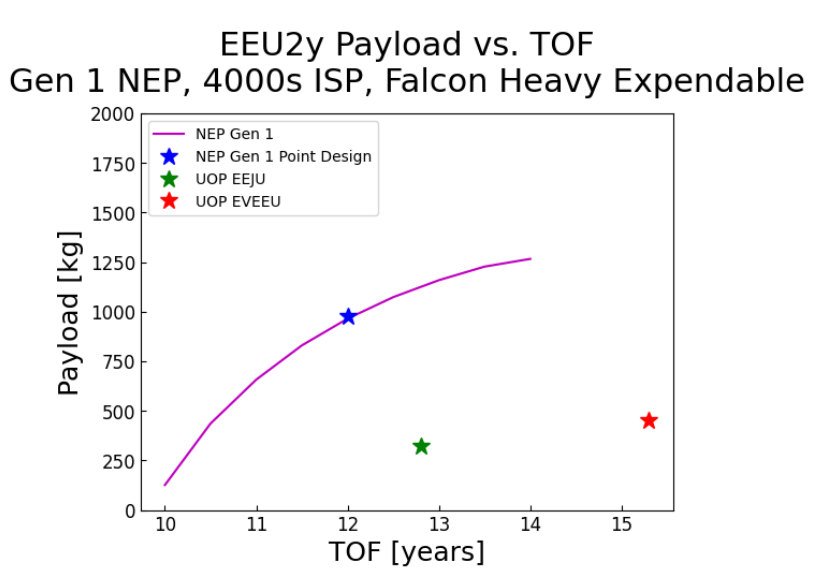


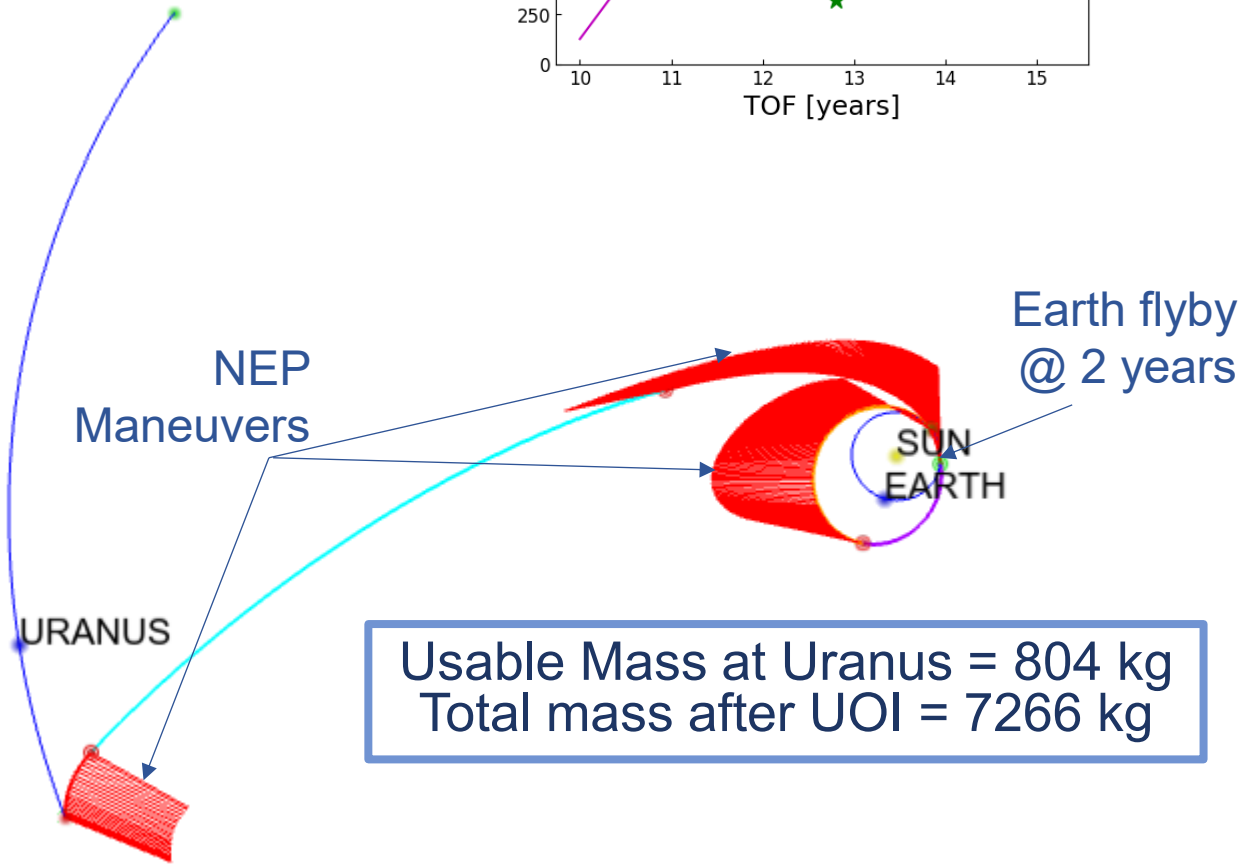
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Earth-Uranus Trajectory Selection

- Choose a point from payload vs. time of flight (TOF) curve
- Design Point:
  - 12-year TOF
  - 20 kW_e power system
    - 3 NEXT-C thrusters using ~19 kW power.
    - 663 mN thrust at I_{sp} = 3910 s
  - 2.5 km/s v_∞ at Uranus arrival
  - Uranus Orbit Insertion: NTO/MMH, 325 s I_{sp}
- Interplanetary EP ΔV = 11 km/s
  - Xenon mass: 2605 kg





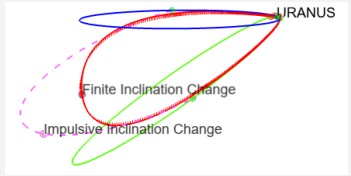
Usable Mass at Uranus = 804 kg
Total mass after UOI = 7266 kg

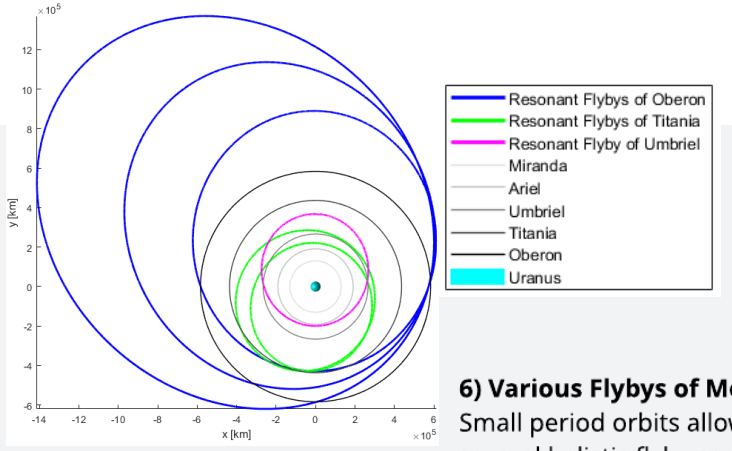
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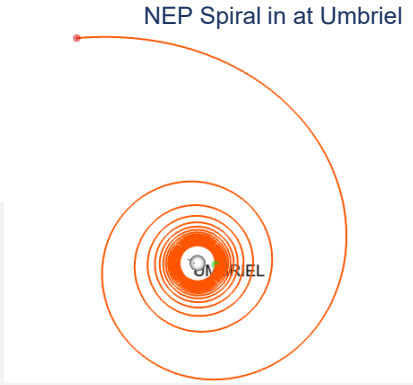
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ConOps Option 1 (12-year to Uranus) – Moon Tour & Orbit of Umbriel

Science Package: Core 100 kg







~180 days

Uranus Arrival
UOP Capture Orbit

2) PRM
Raise Rp to Oberon altitude using NEP.

3) NEP 15° Inclination Change
113 days

EEU Transfer
12 years

5) Orbit Lowering Flyby Sequence
Representative ballistic flyby sequence to lower orbit 655 days

6) Various Flybys of Moons - ~1100 days
Small period orbits allow for targetting of several balistic flyby sequences, with close flybys for science objectives. Specific flyby sequence not planned, but period of orbit about Uranus is <15 days

7) Capture at Major Moon
NEP enables capture at a major moon. Sprial down to 100km orbit is on the order of 10-40 days.

1) Probe Release
Highly elliptical orbit brings spacecraft close to Uranus for probe release

4) Equatorializing Flyby Sequence
15 deg inc change in 7-8 flybys similar to UOP equatorializing flyby sequence. ~250 days

UOP equatorialized over 882 days – but includes lowering apoapsis

8) Disposal at moon
Total Mission Time 18.5 years, matches UOP

Probe: 268 kg

Usable Mass at Uranus = 804 kg
Total mass after UOI = 7266 kg

Segment #	1	2	3	4	5	6	7	8	Total
ΔV (m/s)	~100	375	375	<100	<150	~300	~500	<100	2000

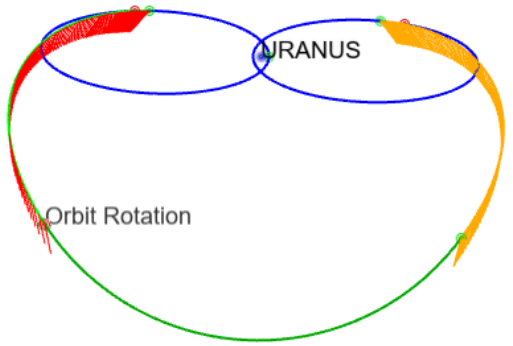
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ConOps Option 2 (13-year to Uranus) – UOP + Magnetotail

Science Package: Enhanced 178 kg

Usable Mass at Uranus = 1042 kg
Total mass after UOI = 8014 kg



~180 days

Uranus Arrival
UOP Capture Orbit

2) PRM
Matches UOP PRM Maneuver

3) NEP used to spin AOP of orbit into magnetotail
~230 days, depending on specific AOP that can be targetted based on arrival time.

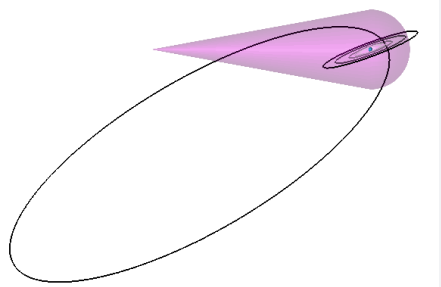
EEU Transfer
13 years

Orbit: 5,040,000 x 183,950km

4) Orbit within Magnetotail
~700 days can be spent in orbit doing science in magnetotail

6) Disposal into Uranus
Total Mission Time 18.5 years, matches UOP

1) Probe Release
Highly elliptical orbit brings spacecraft close to Uranus for probe release



5) Equatorializing Flyby Sequence
880 days, resulting in approximately ~30 deg inc change, includes lowering apoapsis. Assume matching performance of UOP

Probe: 268 kg

Segment #	1	2	3	4	5	6	Total
ΔV (m/s)	~100	178	~1750	<100	<100	~300	2528

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